Amendments to the Drawings:

The attached sheets of drawings include changes to Figure 1 and Figure 4. Figure 1 has been amended to label Figs. 1(a) and 1(b) separately. Figure 4 has been amended to correct a typographical error in that "metastabl" has been corrected to read --metastable--.

Attachments: Replacement Sheets (2)
Annotated Copies Showing Changes (2)

REMARKS

In the Drawings:

The Examiner has objected to the drawings because the word "metastabl" in Fig. 4 should read --metastable--. Applicants have amended Fig. 4 to correct the typographical error.

In addition, Fig. 1 has been amended to separately label Figs. 1(a) and 1(b). Replacement and annotated sheets are attached.

In the Specification:

The Examiner objected to the Abstract for containing the word "said". Applicants have amended the Abstract of the Disclosure herein to correct the language and conform to standard United States practice. A clean copy of the Abstract is attached hereto.

Additionally, the Examiner objected to the specification because of minor typographical and/or grammatical errors. Applicants have reviewed the specification and made appropriate amendments. No new matter has been added. Entry of these amendments is respectfully requested.

In the Claims:

Claims 1-12 are pending in the application.

Claims 3-9 and 11-12 stand rejected under 35 U.S.C. §112, second paragraph, as being indefinite. In addition, claims 3, 5-9 and 11-12 stand rejected as containing certain limitations without clearly indicating the subject matter to which the limitation is to be applied. Applicants have amended the claims herein to address the Examiner's objections.

Rejections under 37 C.F.R. §103(a)

Claims 1-12 stand rejected under 35 U.S.C. §103(a) as being unpatentable over French Publication No. FR 2,790,974 to Scheibner et al. in view of U.S. Patent No. 5,221,446 to Eerkens.

Applicants respectfully traverse the rejections for the reasons set forth below and the Examiner's reconsideration is earnestly solicited.

(a) The Scheibner Method

According to the Scheibner method, thallium atoms in the ground state are excited to a Rydberg state at an energy of 49013cm^{-1} and then field-ionized by applying an external electric field to produce ions. The external electric field should be applied after a laser has been applied.

In the process of exciting thallium atoms to a Rydberg state at an energy level of 49013cm^{-1}, detuning of about 1 GHz is conducted at a first excited state at 26477.5cm^{-1} and at a second excited state at 36199.9cm^{-1} to avoid resonance.

In the Scheibner method, lasers having the wavelength of 377.7nm and 445nm are mainly used, and lasers having the wavelength of 352nm and 850nm can be additionally used to ionize some thallium atoms which are pumped into or fallen to the metastable state at 7792.7cm^{-1}.

The lasers being used in the Scheibner method to separate Tl-203 isotope are preferably pulse lasers having a single frequency to acquire the required 203 Tl isotope selectivity and ionization efficiency.

(b) The Present Method

In the method according to the present invention, thallium atoms in the ground state are excited (resonant excitation) to the excited state (26477.6cm^{-1}) and then pumped into the metastable state (7793cm^{-1}). During the process, the target isotope Tl-203 can be easily and selectively pumped into the metastable state and non-target isotopes are not excited (pumped) and stay in the ground state.

The target isotope pumped into the metastable state (7792.7cm^{-1}) is photoionized to the continuum state through the resonant excited state (42049.0cm^{-1}) by pulse lasers having the wave length 293nm and Nd:YAG lasers having the wave length of 1064nm. Lasers which can be used for the present method could be any lasers having wide linewidth which are commercially available.

(c) Comparison of the Two Methods

The main differences between the Scheibner method and the present method are:

First, the Scheibner method uses the field ionization method, while in the present method the target isotope is photoionized by using IR lasers.

The present invention experimentally indicates that the target isotopes can effectively be photoionized using a laser having the wavelength of 1064nm.

Second, according to the Scheibner method, thallium atoms are excited to a Rydberg state by using a single frequency pulse laser having narrow linewidth which is not resonant at the intermediate state.

However, according to the present method, the continuous wave (CW) laser to produce the first frequency photons has narrow linewidth but is resonant at the intermediate excite state (26477.5cm^{-1}), and the pulse lasers to produce the second and third frequency photons do not have any restriction on linewidth.

Third, consequently, according to the Scheibner method, for high selectivity and high excitation efficiency, laser powers and frequencies should be carefully controlled, whereas according to the present method, high selectivity and high excitation efficiency are easily acquired and commercially practical.

Based on the foregoing amendments and remarks, Applicants respectfully submit that the presently claimed invention is patentably distinguishable over the prior art of record and that claims 1-11 are deemed to be in condition for allowance. The Examiner's reconsideration and favorable action with respect to claims 1-11 are respectfully requested.

Respectfully submitted,
THE WEBB LAW FIRM

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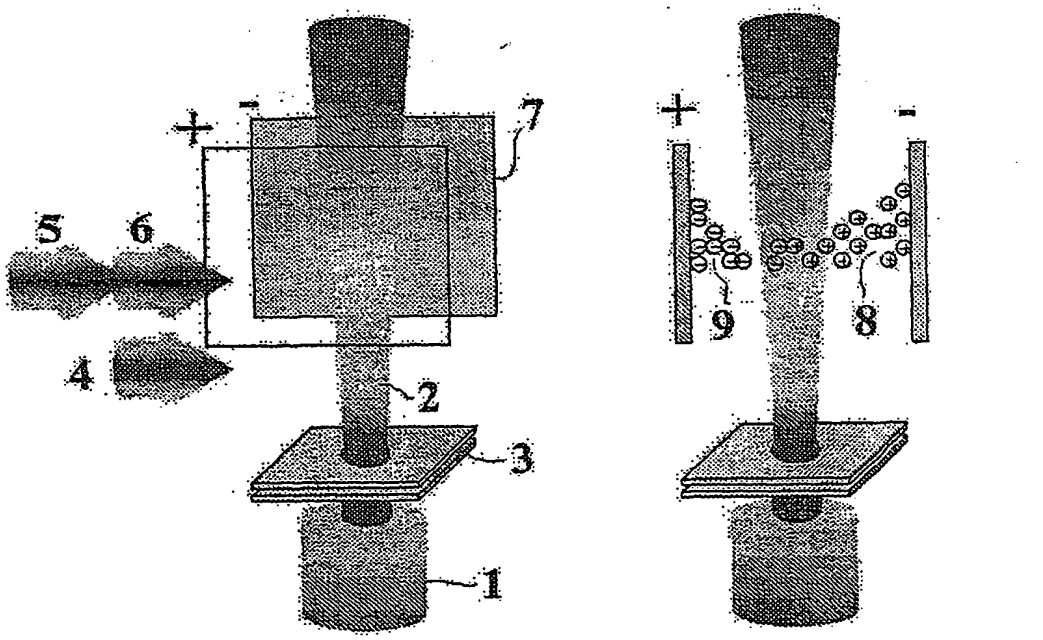
Annotated Sheet Showing Changes



[(a)] [(b)]

-- FIG. 1(a) -- --FIG. 1(b) --

[FIG. 1]

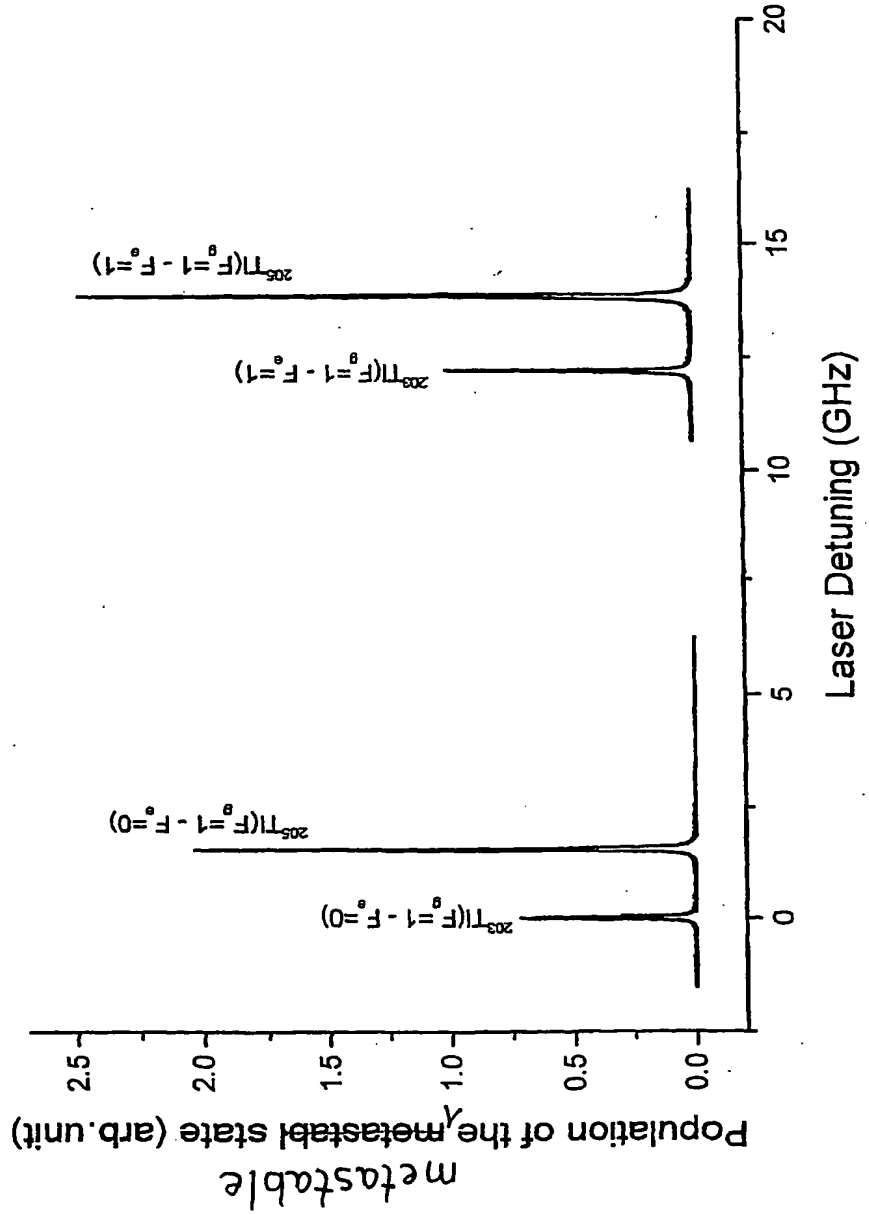

Population of the metastable state (arb.unit)
Laser Detuning (GHz)
0.0
0.5
1.0
1.5
2.0
2.5
0
5
10
15
20
$^{203}Tl(F_g=1 - F_e=0)$
$^{205}Tl(F_g=1 - F_e=0)$
$^{203}Tl(F_g=1 - F_e=1)$
$^{205}Tl(F_g=1 - F_e=1)$

FIG. 4